What is claimed is:

1. An apparatus for providing adaptive signaling in a communication system, the apparatus having a transmitter comprising:

a signaling bit encoder configured to selectively puncture, based on a log-likelihood ratio, one or more bits of a data symbol comprised of a plurality of bits with at least one signaling bit representing signaling information to achieve a punctured data symbol; and

a mapper configured to modulate the punctured data symbol according to a predetermined mapping scheme having predetermined characteristics, the transmitter configured to transmit the modulated punctured data symbol.

2. The apparatus according to claim 1, wherein the transmitter selectively punctures one or more bits of the data symbol with the at least one signaling bit that have a highest inherent log-likelihood ratio among all bits in the data symbol.

3. The apparatus according to claim 1, wherein the predetermined mapping scheme comprises an M-ary Quadrature Amplitude Mapping using a square Karnaugh mapped constellation.

4. The apparatus according to claim 1, wherein the predetermined mapping scheme comprises Gray-coding.

5. The apparatus according to claim 1, wherein each of the data symbols has a prescribed number of odd and even bits.

6. The apparatus according to claim 5, wherein the signaling bit encoder selectively punctures a most significant odd bit position of a data symbol with the at least one signaling bit and adaptively punctures one of one or more lesser significant odd bits in the data symbol or a combination of lesser significant odd bits and a least significant odd bit with predetermined bit values to achieve a prescribed log-likelihood ratio gain for the most significant odd bit position.

7. The apparatus according to claim 5, wherein the signaling bit encoder selectively punctures a most significant even bit position of a data symbol with the at least one signaling bit and adaptively punctures one of one or more lesser significant even bits in the data symbol or a combination of lesser significant even bits and a least significant even bit with predetermined bit values to achieve a prescribed log-likelihood ratio gain for the most significant even bit position.

8. The apparatus according to claim 5, wherein the predetermined characteristics include independence of odd bits in a data symbol from even bits in the data symbol such that the log-likelihood ratio calculated for each of the even bits in the data symbol are only affected by values of other even bits in the data symbol and the log-likelihood ratio calculated for each of the odd bits in the data symbol are only affected by values of other odd bits in the data symbol.

9. The apparatus according to claim 1, further comprising a receiver that is configured to receive transmitted punctured data symbols and calculate a log-likelihood ratio for each bit of the received punctured data symbols and having a decoder configured to extract the signaling information from the at least one signaling bit in the punctured data symbol.

10. The apparatus according to claim 9, wherein the decoder in the receiver is configured to extract signaling information within the punctured bit by determining a sign of the log-likelihood ratio calculated for a bit location into which the at least one signaling bit has been punctured.

11. The apparatus according to claim 10, wherein the decoder assigns the at least one signaling bit a first binary value of when the sign of the calculated log-likelihood ratio is negative and assigns the at least one signaling bit a second binary value when the sign of the calculated log-likelihood ratio is positive.

12. A receiver configured for receiving, decoding and demodulating a data symbol encoded by a transmitter, which transmitter selectively punctures one or more bit locations of the data symbol comprised of a plurality of bits with at least one signaling bit representing signaling information to achieve a punctured data symbol and modulates the punctured data symbol according to a predetermined mapping scheme having predetermined characteristics, the transmitter configured to transmit the modulated punctured data symbol to the receiver, wherein the receiver comprises:

a symbol-to-log-likelihood ratio calculator configured to receive the transmitted punctured data symbol and calculate a log-likelihood ratio for each bit of the received punctured data symbol; and

a signaling channel decoder configured to extract the signaling information from the at least one signaling bit in the punctured data symbol based on the calculated log-likelihood ratio of the at least one signaling bit.

13. The receiver according to claim 12, wherein the one or more bits of the data symbol punctured by the transmitter with the at least one signaling bit have a highest inherent log-likelihood ratio among all bits within the data symbol.

14. The receiver according to claim 12, wherein the predetermined mapping scheme comprises an M-ary Quadrature Amplitude Mapping scheme using a square Karnaugh mapped constellation.

15. The receiver according to claim 12, wherein the predetermined mapping scheme used by the transmitter comprises Gray-coding.

16. The receiver according to claim 12, wherein the signaling channel decoder is configured to extract signaling information within the punctured bit by determining a sign of the log-likelihood ratio calculated by the symbol-to-log-likelihood ratio calculator for a bit location into which the at least one signaling bit has been punctured.

17. The receiver according to claim 16, wherein the signaling channel decoder assigns the at least one signaling bit a first binary value when the sign of the calculated log-likelihood ratio is negative and assigns the at least one signaling bit a second binary value when the sign of the calculated log-likelihood ratio is positive.

18. The receiver according to claim 12, further comprising a zero-fill inserter receiving an output of the symbol-to-log-likelihood calculator and configured to insert a soft value of zero into data symbol bit locations punctured by the transmitter.

19. The receiver according to claim 12, further comprising a bit-wise decoder configured to convert log-likelihood ratios output by the symbol-to-log-likelihood calculator into binary data bits.

20. A method for providing signaling in a communication system comprising steps of:

puncturing one or more particular bits of a data symbol comprised of a plurality of bits with at least one signaling bit representing signaling information to achieve a punctured data symbol, wherein the puncturing is based on a log-likelihood ratio;

modulating the punctured data symbol according to a predetermined mapping scheme having predetermined characteristics; and

transmitting the modulated punctured data symbol.

21. The method according to claim 20, wherein bit locations within a data symbol that have a highest inherent log-likelihood ratio are punctured with the signaling information.

22. The method according to claim 20, wherein the predetermined mapping scheme comprises an M-ary Quadrature Amplitude Mapping using a square Karnaugh mapped constellation.

23. The method according to claim 20, wherein the predetermined mapping scheme comprises Gray-coding.

24. The method according to claim 20, wherein each of the data symbols have a prescribed number of odd and even bits.

25. The method according to claim 24, wherein a most significant odd bit position of a data symbol is selectively punctured with the at least one signaling bit and one of one or more lesser significant odd bits in the data symbol or a combination of lesser significant odd bits and a least significant odd bit with predetermined bit values are adaptively punctured to achieve a prescribed log-likelihood ratio gain for the most significant odd bit position.

26. The method according to claim 24, wherein a most significant even bit position of a data symbol is selectively punctured with the at least one signaling bit and one of one or more lesser significant even bits in the data symbol or a combination of lesser significant even bits and a least significant even bit with predetermined bit values are adaptively punctured to achieve a prescribed log-likelihood ratio gain for the most significant even bit position.

27. The method according to claim 24, wherein the predetermined characteristics include independence of odd bits in the data symbol from even bits in the data symbol such that a log-likelihood ratio calculated for each of the even bits in the data symbol are only affected by values of other even bits in the data symbol and a log-likelihood ratio calculated for each of the odd bits in the data symbol are only affected by values of other odd bits in the data symbol.

28. The method according to claim 20, further comprising steps of:

receiving and demodulating the transmitted data symbol by determining the log-likelihood ratio for each bit of the punctured data symbol based on the predetermined mapping scheme; and

decoding the signaling bits within the demodulated punctured data symbol.

29. The method according to claim 28, wherein signaling information within the punctured bit is extracted by determining a sign of the log-likelihood ratio calculated for a bit location into which the at least one signaling bit has been punctured.

30. The method according to claim 29, wherein the at least one signaling bit is assigned a first binary value when the sign of the calculated log-likelihood ratio is negative and the at least one signaling bit is assigned a second binary value when the sign of the calculated log-likelihood ratio is positive.

31. A method for receiving data, wherein one or more particular bits of a data symbol comprised of a plurality of bits are punctured with one or more signaling bits representing signaling information to achieve a punctured data symbol, wherein the punctured data symbol is modulated according to a predetermined mapping scheme having predetermined characteristics to produce a modulated data symbol, and wherein the method comprises steps of:

receiving the modulated data symbol;

demodulating the modulated data symbol by calculating the log-likelihood ratio for each bit of the punctured data symbol based on the predetermined mapping scheme; and

decoding the signaling bits within the demodulated data symbol.

32. The method according to claim 31, wherein bit locations within a data symbol that have the highest inherent log-likelihood ratio are punctured with the signaling information.

33. The method according to claim 31, wherein the predetermined mapping scheme comprises an M-ary Quadrature Amplitude Mapping using a square Karnaugh mapped constellation.

34. The method according to claim 31, wherein the predetermined mapping scheme comprises Gray-coding.

35. The method according to claim 31, wherein signaling information within the punctured bit is extracted by determining a sign of the log-likelihood ratio calculated for a bit location into which the at least one signaling bit has been punctured.

36. The method according to claim 35, wherein the at least one signaling bit is assigned a first binary value when the sign of the calculated log-likelihood ratio is negative and the at least one signaling bit is assigned a second binary value when the sign of the calculated log-likelihood ratio is positive.